

Ultra-Low Noise Vertical Takeoff and Landing (VTOL)

Completed Technology Project (2017 - 2018)



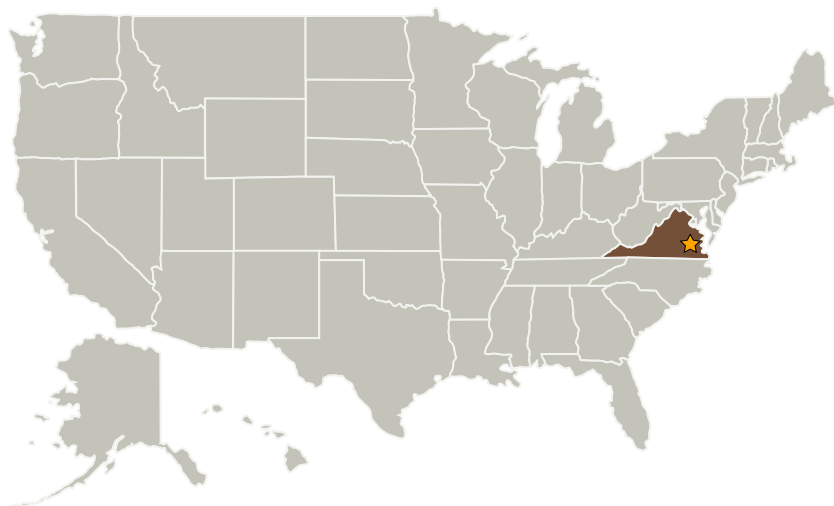
Project Introduction

A unique type of vertical lift propulsor is being designed/analyzed/ developed to push blade passage frequency harmonics above the human audible range, while also having low tip speeds to limit the other low broadband noise components of community noise. Use of distributed electric motors enables small propulsors to be designed in this way, with tight integration across the airframe. This strategy is shown in the figure, comparing the new 20,000 Hz and 285 ft./sec propulsor to 1.5' and 9.7' diameter propellers which have blade passage harmonics at the peak human hearing frequencies along with almost twice the tip speeds (with higher broadband). Use of these small propulsors, each capable of 25 lbf thrust, enables their use in far more distributed ways than merely using propellers or fans. This enables advanced concepts to be developed that leverage airframe shielding to a much greater extent for further noise reduction, along with propulsor positioning to achieve directional reflectivity that causes the remaining noise to be focused upwards, and away from the community.

Anticipated Benefits

Benefit to NASA Aeronautics Quiet VTOL initiative

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★ Langley Research Center (LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Aero Lift Express	Supporting Organization	Industry	
Army Combined Arms Support Command (CASCOM)	Supporting Organization	US Government	Fort Lee, Virginia
UnRealWorx	Supporting Organization	Industry	

Primary U.S. Work Locations

Virginia

Project Transitions

**October 2017:** Project Start**September 2018:** Closed out

Closeout Summary: A new type of vertical lift propulsor was designed/analyzed/developed to ideally match up to electric motor characteristics, with unique acoustic characteristics that offer the potential for breakthrough community noise.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Center Innovation Fund: LaRC CIF

Project Management

Program Director:

Michael R Lapointe

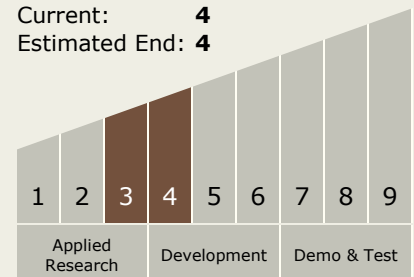
Program Manager:

Julie A Williams-byrd

Principal Investigator:

Paul M Rothhaar

Technology Maturity (TRL)

Start: **3**Current: **4**Estimated End: **4**

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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.4 Aeroacoustics

Target Destination

Earth